WE CLAIM:

1. A variable rate multi-arc leaf spring assembly comprising:

a main leaf spring constructed of a composite material, said main leaf spring defining a central arc portion having a first radius and at least one peripheral arc portion having a second radius not equal to said first radius,

wherein said main leaf spring provides a continuous non-linear variable spring deformation rate.

2. The variable rate multi-arc leaf spring assembly of claim 1 wherein said composite material consists of a fiber-reinforced resin.

3. The variable rate multi-arc leaf spring assembly of claim 1 wherein said main leaf spring defines a uniform cross-sectional area throughout its length.

4. The variable rate multi-arc leaf spring assembly of claim 1 wherein said main leaf spring further includes at least one integral mounting end connected with said at least one peripheral arc portion, said at least one mounting end adapted to be connected to a loading structure.

5. The variable rate multi-arc leaf spring assembly of claim 4 wherein said at least one integral mounting end comprises a mounting eyelet.

6. The variable rate multi-arc leaf spring assembly of claim 5 wherein said a mounting eyelet includes a metallic insert for installation.

7. The variable rate multi-arc leaf spring assembly of claim 1 further comprising a load plate, said load plate adjacent said leaf spring, wherein said load plate continuously engages said leaf spring during a predetermined set of payload conditions to enhance said continuous non-linear variable spring deformation rate.

8. The variable rate multi-arc leaf spring assembly of claim 7 wherein said load plate is constructed of same said composite material as said main leaf spring.

9. The variable rate multi-arc leaf spring assembly of claim 7 wherein said load plate defines a uniform cross-sectional area throughout its length.

10. The variable rate multi-arc leaf spring assembly of claim 7 further comprising an intermediary member spaced between said leaf spring and said load plate.

11. The variable rate multi-arc leaf spring assembly of claim 10 wherein said intermediary member is constructed of urethane.

Sub a3

12. A variable rate multi-arc leaf spring assembly comprising:

a main leaf spring constructed of a composite material, said main leaf spring defining a central arc portion having a first radius and at least one peripheral arc portion having a second radius not equal to said first radius, wherein said main leaf spring provides a continuous non-linear variable spring deformation rate; and

a load plate, said load plate adjacent said leaf spring, wherein said load plate continuously engages said leaf spring during a predetermined set of payload conditions to enhance said continuous non-linear variable spring deformation rate.

13. The variable rate multi-arc leaf spring assembly of claim 12 wherein said composite material consists of a fiber-reinforced resin.

14. The variable rate multi-arc leaf spring assembly of claim 12 wherein said main leaf spring defines a uniform cross-sectional area throughout its length.

15. The variable rate multi-arc leaf spring assembly of claim 12 wherein said main leaf spring further includes at least one integral mounting end connected with said at least one peripheral arc portion, said at least one mounting end adapted to be connected to a loading structure.

16. The variable rate multi-arc leaf spring assembly of claim 15 wherein said at least one integral mounting end comprises a mounting eyelet.

17. The variable rate multi-arc leaf spring assembly of claim 16 wherein said a mounting eyelet includes a metallic insert for installation.

18. The variable rate multi-arc leaf spring assembly of claim 12 wherein said load plate is constructed of same said composite material as said main leaf spring.

19. The variable rate multi-arc leaf spring assembly of claim 12 wherein said load plate defines a uniform cross-sectional area throughout its length.

20. The variable rate multi-arc leaf spring assembly of claim 12 further comprising an intermediary member spaced between said leaf spring and said load plate.

21. The variable rate multi-arc leaf spring assembly of claim 20 wherein said intermediary member is constructed of urethane.

22. A variable rate multi-arc leaf spring assembly comprising:

a main leaf spring constructed of a composite material, said main leaf spring defining a plurality of arced sections integrated along length of said main leaf spring, at least two of said sections having different spring rates;

wherein said main leaf spring provides a continuous non-linear variable spring deformation rate.

23. The variable rate multi-arc leaf spring assembly of claim 22 wherein said main leaf spring further includes at least one integral mounting end connected with at least one of said arced sections, said at least one mounting end adapted to be connected to a loading structure.

24. The variable rate multi-arc leaf spring assembly of claim 23 wherein said at least one integral mounting end comprises a mounting eyelet.

25. The variable rate multi-arc leaf spring assembly of claim 24 wherein said a mounting eyelet includes a metallic insert for installation.

26. The variable rate multi-arc leaf spring assembly of claim 22 further comprising a load plate, said load plate adjacent said leaf spring, wherein said load plate continuously engages said leaf spring during a predetermined set of payload conditions to enhance said continuous non-linear variable spring deformation rate.

27. The variable rate multi-arc leaf spring assembly of claim 26 further comprising an intermediary member spaced between said leaf spring and said load plate.

28. A method of achieving a continuous non-linear variable spring deformation rate for a multi-arc leaf spring assembly comprising:

providing a main leaf spring constructed of a composite material, said main leaf spring defining a central arc portion having a first radius and at least one peripheral arc portion connected with said central arc portion and having a second radius not equal to said first radius;

providing a load plate, said load plate adjacent said leaf spring;

applying a downward force to said main leaf spring to achieve a soft spring rate; and

applying an increased downward force to said main leaf spring, wherein said main leaf spring progressively and continuously engages said load plate to achieve a hard spring rate and a smooth transition from said soft spring rate to said hard spring rate.

29. The method of claim 28 wherein said main leaf spring further includes at least one integral mounting end connected with said at least one peripheral arc portion, said at least one mounting end adapted to be connected to a loading structure.

30. The method of claim 28 further comprising the method of separating said main leaf spring from said load plate under empty payload conditions with an intermediary member.